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PATENT ABSTRACTS OF JAPAN

(11)Publication number : **2003-038460**
(43)Date of publication of application : **12.02.2003**

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(51)Int.Cl. A61B 5/08

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(21)Application number :	**2001-236468**	(71)Applicant :	**MITSUBISHI PHARMA CORP** **TORAY IND INC**
(22)Date of filing :	**03.08.2001**	(72)Inventor :	**SHIBUYA ATSUO** **OTA NAO**

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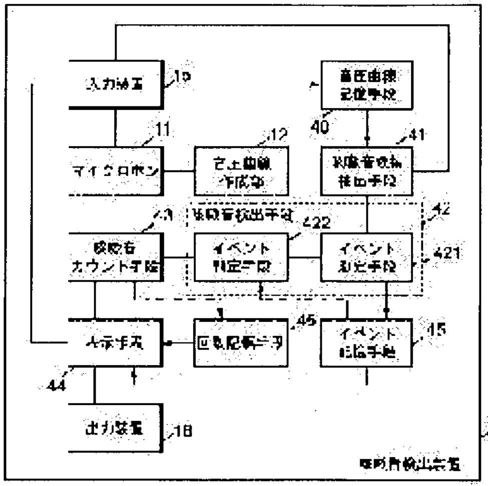
(54) COUGH SOUND DETECTOR, COUGH SOUND DETECTING METHOD, COUGH SOUND DETECTING PROGRAM AND INFORMATION STORAGE MEDIUM

(57)Abstract:

PROBLEM TO BE SOLVED: To detect a cough sound from breathing sound with good accuracy and automatically record the number of times of coughs.

SOLUTION: This cough sound detector is provided with a sound pressure curve creating means for creating a sound pressure curve from voice signals continuous in time series, a cough sound candidate extract means for extracting an area where sound pressure above a designated value continues for more than designated time from the sound pressure curve to be taken as a cough sound candidate, and a cough sound detecting means for determining whether the cough sound candidate is a cough sound or not for every cough sound candidate. The cough sound detecting means is provided with an event measuring means for measuring a rising gradient and kurtosis, and if necessary, the maximum sound pressure of the cough sound candidate, and an event determining means for determining whether the cough sound candidate is a cough sound or not according to the rising gradient and kurtosis thereof.

図 4



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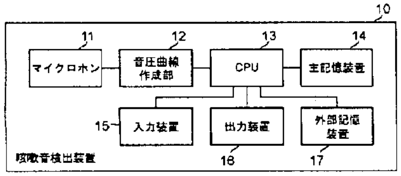
DRAWINGS

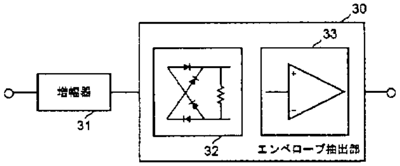
[Drawing 2]

図 2


10
11
マイクロホン
12
音圧曲線作成部
13
CPU
14
主記憶装置
15
入力装置
出力装置
16
外部記憶装置
17
咳嗽音検出装置

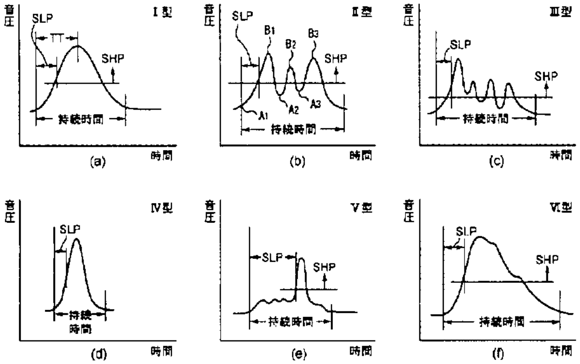
[Drawing 3]

図 3


30
33
増幅器
31
32
エンベロープ抽出部

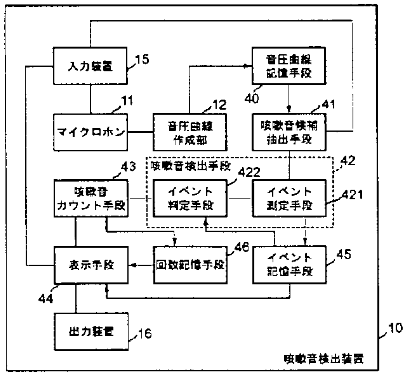
[Drawing 1]

図 1



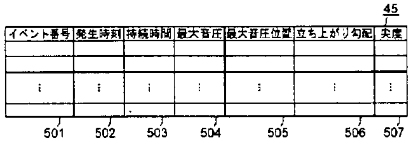
[Drawing 4]

図 4


入力装置
15
音圧曲線記憶手段
40
11
マイクロホン
12
音圧曲線作成部
41
咳嗽音候補抽出手段
42
咳嗽音検出手段
43
咳嗽音カウント手段
422
イベント判定手段
イベント測定手段
421
46
表示手段
回数記憶手段
イベント記憶手段
45
44
出力装置
16
10
咳嗽音検出装置

[Drawing 5]

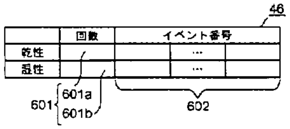
図 5


45
501
502
503
504
505
506
507

イベント番号	発生時刻	持続時間	最大音圧	最大音圧位置	立ち上がり勾配	尖度
⋮	⋮	⋮	⋮	⋮	⋮	⋮

[Drawing 6]

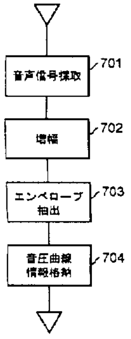
図 6


46
601
601a
601b
602

	回数	イベント番号		
乾性			…	
湿性			…	

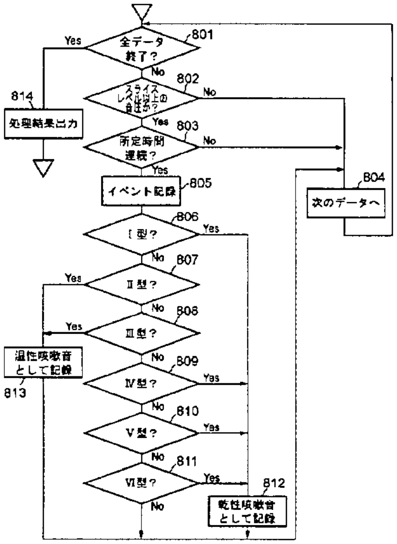
[Drawing 7]

図 7


音声信号採取
701
増幅
702
エンベロープ
抽出
703
音圧曲線
情報格納
704

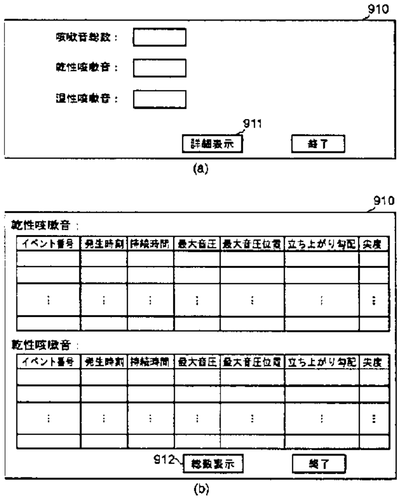
[Drawing 8]

図 8


全データ
終了？
801
Yes
No
スライス
レベル以上の
音圧か？
802
No
Yes
所定時間
連続？
803
No
Yes
814
処理結果出力
804
次のデータへ
イベント記録
805
I 型？
806
Yes
No
II 型？
807
Yes
No
III 型？
808
Yes
No
湿性咳嗽音
として記録
813
IV 型？
809
Yes
No
V 型？
810
Yes
No
VI 型？
811
Yes
No
812
乾性咳嗽音
として記録

[Drawing 9]

図 9


910
咳嗽音総数：
乾性咳嗽音：
湿性咳嗽音：
911
詳細表示
終了
(a)
910
乾性咳嗽音：
イベント番号
発生時刻
持続時間
最大音圧
最大音圧位置
立ち上がり勾配
尖度
乾性咳嗽音：
イベント番号
発生時刻
持続時間
最大音圧
最大音圧位置
立ち上がり勾配
尖度
912
総数表示
終了
(b)

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the explanatory view showing the classification of ****** by the configuration of a sound pressure curve.
[Drawing 2] It is the hardware configuration Fig. of the ****** detection equipment in an example.
[Drawing 3] It is the mimetic diagram showing the configuration of the sound pressure curvilinear creation section in an example.
[Drawing 4] It is the functional block diagram of the ****** detection equipment in an example.
[Drawing 5] It is the explanatory view showing the DS of the event storage means in an example.
[Drawing 6] It is the explanatory view showing the DS of the count storage means in an example.
[Drawing 7] It is the flow chart showing the flow of the processing in the sound pressure curvilinear creation section of an example.
[Drawing 8] It is the flow chart showing the flow of processing by the ****** detection equipment of an example.
[Drawing 9] It is the explanatory view showing the example of an output screen.
[Description of Notations]
10 -- ****** detection equipment, 11 -- A microphone, 12 -- Sound pressure curvilinear creation section, 13 -- Arithmetic and program control (CPU), 14 -- Main storage, 15 -- Input unit, 16 -- An output unit, 17 -- External storage, 30 -- Envelope extract section, 31 [-- Candidate / ****** / extract means,] -- Amplifier, 32 -- A rectifier circuit, 33 -- A filter circuit, 41 42 [-- An event storage means, 46 / -- A count storage means, 421 / -- An event measurement means, 422 / -- An event judging means, 910 / -- A display screen, 911 / -- A detail display carbon button, 912 / -- Total display carbon button.] -- A ****** detection means, 43 -- A ****** count means, 44 -- A display means, 45

[Translation done.]

[Claim 13] The sound pressure curvilinear creation step which creates a sound pressure curve from the sound signal which continued by time series, The candidate [******] extract step which the sound pressure beyond a predetermined value extracts the field maintained beyond predetermined time, and makes the candidate ******, from the above-mentioned sound pressure curve, It has the ****** detection step which judges whether it is ****** for every above-mentioned candidate ******. The above-mentioned ****** detection step The ****** detection approach characterized by having the event measurement step which measures standup inclination and kurtosis of the above-mentioned candidate ******, and the event judging step the above-mentioned candidate ****** judges whether it is ****** based on the above-mentioned standup inclination and kurtosis to be.

[Claim 14] A sound pressure curvilinear creation means to create a sound pressure curve from the sound signal which continued the computer by time series in order to detect ****** in the respiratory sound, The candidate [******] extract means which the sound pressure beyond a predetermined value extracts the field maintained beyond predetermined time, and makes the candidate ******, from the above-mentioned sound pressure curve, It is a ****** detection program for considering as a ****** detection means to judge whether it is ******, and making it function for every above-mentioned candidate ******. And the above-mentioned ****** detection means The ****** detection program characterized by having an event measurement means to measure standup inclination and kurtosis of the above-mentioned candidate ******, and an event judging means by which the above-mentioned candidate ****** judges whether it is ****** based on the above-mentioned standup inclination and kurtosis.

[Claim 15] The information record medium which recorded the ****** extract program according to claim 14 and in which computer reading is possible.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the approach, the program, the equipment, and the storage for identifying ******.
[0002]
[Description of the Prior Art] **** which happens reflectively by stimulus of respiratory tract membrane is one of the main symptoms of a respiratory tract disease, and it is very important to grasp the class and count of **** objective and to record them, when judging symptoms and performing diagnosis and medication.
[0003] However, generally, natural **** needs the observation covering a long time, in order to generate irregularly and suddenly, and to record this correctly, since frequency is not uniform, and it is difficult to carry out only by limited consultation hours.
[0004] Then, long duration sound recording of a patient's respiratory sound is carried out, and the respiratory supervisory equipment which analyzes a sound recording result acoustically and extracts extraordinary noises, such as ******, is proposed (JP,58-165823,A).
[0005]
[Problem(s) to be Solved by the Invention] However, this approach was not enough as the detection precision of ****, and especially productive cough gargling was hardly able to be detected by it.
[0006] Then, this invention aims at offering the ****** extract approach that ****** contained in the respiratory sound is detectable with a sufficient precision, the **** recording device using this approach, the ****** extract program for detecting ****** using this approach, and the information storage holding this program.
[0007]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, in this invention, it judges whether the standup inclination of the candidate [******] (event) field in a sound pressure curve, kurtosis, and when required, it is what the event depends on ****** using the data of the concept of a maximum-sound-pressure location.
[0008] Namely, a sound pressure curvilinear creation means to create a sound pressure curve in this invention from the sound signal which continued by time series, The candidate [******] extract means which extracts the field which the sound pressure beyond a predetermined value (it is called slice level) maintained beyond predetermined time from the sound pressure curve, and is made into the candidate ******, It has a ****** detection means by which it judges whether it is ****** for every candidate of this ******. A ****** detection means ****** detection equipment equipped with an event measurement means to measure standup inclination and kurtosis of the candidate ******, and an event judging means by which the candidate ****** judges whether it is ****** based on the standup inclination and kurtosis is offered.
[0009] Moreover, in this invention, in order to detect ****** in the respiratory sound, the record medium which recorded the ****** detection program and this program for operating a computer as each above-mentioned means and in which computer reading is possible is offered. In addition, especially the record approach of a record medium is not limited and can use suitably an optical recording medium, a magnetic-recording medium, a magneto-optic-recording medium, etc.
[0010] The sound pressure curvilinear creation step which furthermore creates a sound pressure curve by this invention from the sound signal which continued by time series, The candidate [******] extract step which the sound pressure beyond a predetermined value (slice level) extracts the field maintained beyond predetermined time, and makes the candidate ******, from a sound pressure curve, It has the ****** detection step which judges whether it is ****** for every candidate ******. A ****** detection step The ****** detection approach equipped with the event measurement step which measures standup inclination and kurtosis of the candidate ******, and the event judging step with which start and the candidate ****** judges whether it is ****** based on inclination and kurtosis to be is offered.
[0011]
[Embodiment of the Invention] ****** can be classified into six of I-VI from the wave of the sound pressure curve. The typical sound pressure curve of ****** of each mold is shown in drawing 1 . In addition, II type ****** which I-beam ****** shown in drawing 1 (a) is general dry cough ****, and is shown in drawing 1 (b) is general productive cough ****. III type ****** shown in drawing 1 (c) is productive cough ****, and IV-VI type ****** shown in drawing 1 (d) - (f) is dry cough ****.
[0012] In this invention, ****** is detected using the persistence time of an event, a maximum-sound-pressure location, wave-like standup inclination, and wave-like kurtosis paying attention to these wave-like descriptions.
[0013] Here, the persistence time of an event is time amount after sound pressure reaches slice level until it becomes under slice level, and this persistence time usually makes preferably the persistence time of the event made into the candidate ****** 40 or more mses 800 or less ms 40 or more mses 1 or less second. In addition, as for the event of under a value (although it can determine suitably according to the used amplifying circuit, it is [a sound recording environment, the sound recording approach and sound recording equipment, and] 0.2V, for example) predetermined in maximum sound pressure, excepting from the candidate ****** is desirable. Although the slice level used as a sound pressure reference value for extracting the field (event) which serves as the candidate ****** from a sound pressure curve can be suitably determined according to a sound recording environment, the sound recording approach and sound

recording equipment, the used amplifying circuit, it is usually desirable to be referred to as 0.01-0.02V.

[0014] after sound pressure reaches slice level namely,, the time amount taken after the event to the event persistence time begins before reaching maximum sound pressure comes out of the maximum-sound-pressure location in an event (it abbreviates to TT) comparatively.

[0015] moreover, it starts, and after sound pressure reaches slice level namely,, the time amount taken after the event to the event persistence time begins before reaching 50% of value of maximum sound pressure comes out of inclination (it abbreviates to SLP) comparatively. In addition, the differential value of a sound pressure curve after an event begins until it reaches maximum sound pressure may be used as an index which starts and shows inclination.

[0016] Kurtosis (it abbreviates to SHP) is the rate of the time amount (or the number of data) which was the sound pressure more than 40 - 50% of maximum sound pressure (preferably 40%) to the event persistence time (or the total number of data in an event).

[0017] In order to detect ****** of each type mentioned above, as for an event judging means, it is desirable to have each 1-7th following judgment means. Although it is desirable to have all as for these judgment means, they may be equipped only with any one and may be equipped with it or more combining two.

[0018] In order to detect ****** of an I-beam, II mold, and an III mold collectively, it is desirable for an event judging means to start and to equip it with 1st judgment means by which inclination judges that the candidate ****** who is below a predetermined upper limit (usually 10 - 160 ms [Although based also on the extraction condition of an envelope], preferably 10 - 40 ms, more preferably 30 mses), and is below a upper limit (55 - 60%, preferably 55%) predetermined in kurtosis is ******.

[0019] An event measurement means measures further the maximum-sound-pressure location in a candidate [******] field, an event judging means takes action to detect ****** of an I-beam, and inclination is a predetermined upper limit (although based also on the extraction condition of an envelope). Usually, they are below 30 mses more preferably ten to 40 ms ten to 160 ms. Kurtosis is below a upper limit (30 - 40%, preferably 40%), and it is desirable to have the 2nd judgment means which judges that the candidate ****** whose maximum-sound-pressure location is below a predetermined upper limit (40 - 60%, preferably 50%) is dry cough ****.

[0020] The wave in a candidate [******] field has two or more peaks, an event judging means takes action to detect ****** of II mold, and inclination is a predetermined upper limit (although based also on the extraction condition of an envelope). Usually, they are below 15 mses more preferably five to 25 ms five to 100 ms. It is desirable to have the 3rd judgment means which judges that the candidate ****** who is below a predetermined upper limit (55 - 60%, preferably 55%) is productive cough **** more than a lower limit (30 - 40%, preferably 40%) predetermined in kurtosis.

[0021] In addition, for a peak, the sound pressure of the location A (in drawing 1 (b), it illustrates as A1 - A3) where the wave started the rise is predetermined level (the maximum sound pressure in an event 10 to 50%) here. The sound pressure of the location B (in drawing 1 (b), it illustrates as B1-B3) which is below 20% preferably and was changed to descent from the rise after that is predetermined level (the maximum sound pressure in an event 10 to 50%). It is more than 33% preferably, and time amount until it results [from A] in the following A says a long wave form field from a predetermined lower limit (usually 10 - 160 ms [Although based also on the extraction condition of an envelope], preferably 10 - 40 ms, more preferably 30 mses).

[0022] The wave in a candidate [******] field has two or more peaks, an event judging means takes action to detect ****** of an III mold, and inclination is a predetermined upper limit (although based also on the extraction condition of an envelope). Usually, it is desirable to have the 4th judgment means which judges that the candidate ****** whose kurtosis it is below 30 mses more preferably and is below a predetermined upper limit (30 - 40%, preferably 40%) is productive cough **** ten to 40 ms preferably ten to 160 ms.

[0023] In order to detect ****** of IV mold, for the persistence time, an event judging means is a predetermined upper limit (although based also on the extraction condition of an envelope). Usually, 40 to 400 ms, it is under 70 mses more preferably, and starts 40 to 100 ms preferably, and inclination is a predetermined upper limit (although based also on the extraction condition of an envelope). Usually, i is desirable to have the 5th judgment means which judges that the candidate ****** who is under 10 mses more preferably is dry cough **** five to 50 ms preferably five to 200 ms.

[0024] In order to detect ****** of a V type, it is desirable to equip an event judging means with 6th judgment means by which kurtosis judges that the candidate ****** who is under a predetermined upper limit (5 - 30%, preferably 15%) is dry cough ****.

[0025] An event judging means takes action to detect VI type ******, and inclination is a predetermined upper limit (although based also on the extraction condition of an envelope). Usually, they are below 15 mses more preferably ten to 40 ms ten to 160 ms. It is desirable to have the 7th judgment means which judges that the candidate ****** who is below a predetermined upper limit (55 - 60%, preferably 55%) is dry cough **** more than a lower limit (30 - 40%, preferably 40%) predetermined in kurtosis.

[0026] In addition, the ****** detection equipment of this invention can be further equipped with a ****** count means to count the count of detected ******. Moreover, you may make it count dry cough **** and productive cough **** separately.

[0027] **** and productive cough gargling especially accompanied by expectoration may do the serious effect also for a patient's life, and the objective record is searched for as a concrete index about the effectiveness of those drugs as a decision ingredient about administration of antitussive, an expectorant, etc. Since according to this invention it can detect with a sufficient precision about both dry cough gargling and productive cough gargling, the count can be recorded automatically, it can detect with a precision sufficient also about productive cough gargling especially when it has the 3rd judgment means and/or the 4th judgment means of detecting productive cough **** and productive cough gargling and dry cough gargling can be distinguished and recorded, it is useful to especially the judgment of condition of disease or drug effect.

[0028] In addition, the extracted data may be used for the sound signal used in this invention as it is, and what was once recorded may be used for it. When using what was recorded, in order to protect a test subject's privacy, it is desirable to encipher the recorded data. When doing in this way, it is desirable to have further a means to receive an input although ****** detection equipment enciphered the signal of the voice recorded beforehand, and the means which decrypts the enciphered signal and is made into a sound signal.

[0029] Moreover, since it is not recorded as voice even if it changes the extracted sound signal into a sound pressure curve, without recording, a test subject's privacy can be protected. When doing in this way, it is desirable to equip ****** detection equipment with the microphone for extracting a sound signal further. In addition, if a means to receive the input of the sound signal from the outside, or a means to read the sound signal recorded beforehand is established, it is not necessary to form a microphone.

[0030] The hardware which can carry out by extracting an envelope from a sound signal, for example, is equipped with a rectifier circuit

and a filter circuit may perform creation of a sound pressure curve, and software may perform it.
[0031]
[Example] The ****** detection equipment used by <example 1> A. hardware configuration this example As shown in drawing 2 , it is a test subject's respiratory sound (in this specification with the respiratory sound). not only the sound of breathing but a test subject's ****** and voice list -- the surrounding noise -- containing -- with the microphone 11 for extracting It is an information processor equipped with the sound pressure curvilinear creation section 12 which creates a sound pressure curve from the extracted respiratory sound, arithmetic and program control 13, main storage 14, an input unit 15, an output unit 16, and external storage 17. The sound pressure curvilinear creation section 12 of this example is equipped with the amplifier 13 for amplifying the inputted sound signal, and the envelope extract section 30 equipped with the rectifier circuit 32 and the 100Hz low pass filter circuit 33 which have four diodes as shown in drawing 3 .
[0032] B. The ****** detection equipment 10 of functional configuration this example As shown in drawing 4 , the input unit 15 and output unit 16 for a user interface, The microphone 11 for extracting a sound signal, and the sound pressure curvilinear creation section 12 for extracting an envelope from a sound signal and obtaining a sound pressure curve, The sound pressure curvilinear storage means 40 which is a storage region for holding a sound pressure curve, The candidate [******] extract means 41 for extracting the event which serves as a candidate of ****** from a sound pressure curve, The ****** detection means 42 for detecting ****** from the candidate ******, and the ****** count means 43 for counting the count of detected ******, It has the display means 44 for outputting a count result to the display screen of an output unit 16, the event storage means 45 which is a storage region for holding the various measured value about the candidate ******, and the count storage means 46 which is a storage region for holding the count of ******.
[0033] Moreover, about the sound pressure curvilinear wave of the event which is the candidate ******, the ****** detection means 42 measures the various characteristic values of an event, and is equipped with an event measurement means 421 to store in the event storage means 45, and an event judging means 422 to judge whether it is what the event depends on ****** using this measured value.
[0034] The sound pressure curvilinear storage means 40, the event storage means 45, and the count storage means 46 are storage regions secured to main storage 14 and external storage 17 if needed. The sound pressure curvilinear storage means 40 is a storage region for holding the sound pressure data which followed time series. The event storage means 45 is equipped with the event number storage region 501, the generating time-of-day storage region 502, the persistence time storage region 503, the maximum-sound-pressure storage region 504, the maximum-sound-pressure location storage region 505, the standup inclination storage region 506, and the kurtosis storage region 507 for every event of the extracted candidate ******, as shown in drawing 5 . The count storage means 46 is equipped with the count storage region 601 for holding the count of ******, and the event number storage region 602 for holding the event number of detected ****** for every dry cough **** and productive cough ****, as shown in drawing 6 .
[0035] In addition, in this example, although each means 40-46 are realized when arithmetic and program control 13 executes the program which is held beforehand at the information record medium in which computer reading is possible, and was read into main storage 14 through external storage 17, this invention is not limited to what is depended on such software, and may realize a part or all of each means with the combination of hardware, such as a hard wired logic, or hardware, and software.
[0036] In this example, the microphone 11 for extracting a sound signal and the sound pressure curvilinear creation section 12 for creation of a sound pressure curve are formed in ****** detection equipment 10. However, what is necessary is just to establish the means which reads the recorded sound signal from a storage instead of a microphone 11, when using the respiratory sound recorded beforehand as input data. Moreover, when using the sound pressure curve created beforehand as input data, a microphone 11 and the sound pressure curvilinear creation section 12 can be omitted.
[0037] C. The ****** detection equipment 10 of flow this example of processing If extraction of a sound signal is directed through an input unit 15, until termination of extraction is directed through an input unit 15 As shown in drawing 7 , a sound signal is extracted through a microphone 11 (step 701). The signal acquired by the amplifier 31 is amplified (step 702), the envelope extract section 30 extracts an envelope (step 703), and an extract result is stored in the sound pressure curvilinear storage means 40 (step 704). Thereby, a sound pressure curve is created from the sound signal which continued by time series.
[0038] Moreover, if **** sound detection is directed through an input unit 15, as ****** detection equipment 10 is shown in drawing 8 , the candidate [******] extract means 41 will take out the sound pressure data of a processing object with reference to a sound pressure curvilinear storage means first according to time series. If there are data which should be processed here (step 801), with [the sound pressure of processing-object data] slice level [more than] (this example 0.01 V) (step 802), the candidate [******] extract means 41 will carry out sequential reference of the sound pressure data until it becomes below slice level, and it will find the persistence time of the sound pressure more than slice level, and it will inspect whether it is the time amount (this example 40 or more mses, 800 mses or less) of predetermined within the limits (step 803). Here, when predetermined time continuation of whether sound pressure is under slice level is not carried out (step 803) (step 802), the candidate [******] extract means 41 advances a processing object to the following sound pressure data (step 804), and returns processing to step 801.
[0039] When the persistence time is predetermined within the limits in step 803, the event measurement means 421 stores in the event storage means 45 with the event number attached one by one whenever the candidate ****** is detected by and starting in inclination and kurtosis (the number of data which was 40% or more of sound pressure of maximum sound pressure to the total number of data in an event in this example comparatively), the generating time of day of the event (candidate ******), the persistence time, maximum sound pressure, and (step 805). [maximum sound pressure]
[0040] Then, the event judging means 422 inspects whether the sound pressure curvilinear configuration of the candidate ****** corresponds to either of the I-VI molds (steps 807-811). Here, when it corresponds to neither of the molds, the event judging means 422 returns processing to step 804.
[0041] Moreover, when it corresponds to I and an IV-VI mold, the event judging means 422 advances processing to step 804, after carrying out 1 **** of the values which count storage region 601a of dry cough **** holds while storing the event number in the event number storage region 602 of the count storage means 46 as dry cough **** (step 812).
[0042] When it corresponds to II and an III mold, the event judging means 422 advances processing to step 804, after carrying out 1 **** of the values which count storage region 601b of productive cough **** holds while storing the event number in the event number

storage region 602 of the count storage means 46 as productive cough **** (step 813).

[0043] When processing of all data is completed in step 801, the display means 44 outputs the total count of ******, the count of dry cough ****, and the count of productive cough **** to the display screen 910 of an output unit 16 with reference to the contents of the event storage means 45 and the count storage means 46, as shown in drawing 9 (a).

[0044] Moreover, if the detail display directions by selection of the detail display carbon button (selection field) 911 are received through an input device 15, the display means 44 will display the information held at the event storage means 45 about each of dry cough **** and productive cough ****, as shown in drawing 9 (b). Moreover, the total display carbon button (selection field) 912 is formed in the display screen for this detail display. If selection of this carbon button 912 is received through an input device 15, the display means 44 will output the count display screen shown in drawing 9 (a) to the display screen 910 of an output unit 16.

[0045] D. a criterion -- below, explain the criterion in steps 806-811. The standup inclination of the candidate ****** will be 30 or less mses, kurtosis is 40% or less, and if a maximum-sound-pressure location is 50% or less, the event judging means 422 of this example will judge that the candidate concerned ****** is dry cough **** (step 806), and will advance processing to step 812.

[0046] Moreover, the sound pressure curve in a candidate [******] field has two or more peaks (). Namely, the sound pressure of the location A where the sound pressure curve started the rise is 20% or less of the maximum sound pressure in the field concerned. The sound pressure of the location B changed to descent from the rise after that is 1/3 or more [of the maximum sound pressure in the field concerned]. Time amount until it results in B from A is longer than 30 mses, and if the standup inclination of the candidate concerned ****** is 15 or less mses and kurtosis is 40% or more and 55% or less The event judging means 422 judges that the candidate concerned ****** is productive cough **** (step 807), and advances processing to step 813.

[0047] The sound pressure curve in a candidate [******] field has two or more peaks (two or more the criterion of whether to have a peak is the same as that of step 807), and the standup inclination of the candidate concerned ****** will be 30 or less mses, and if kurtosis is 40% or less, the event judging means 422 will judge that the candidate concerned ****** is productive cough **** (step 808), and will advance processing to step 813.

[0048] The persistence time of the candidate ****** is less than 70 mses, and by starting, if inclination is less than ten mses, the event judging means 422 will judge that the candidate concerned ****** is dry cough **** (step 809), and will advance processing to step 812.

[0049] If the kurtosis of the candidate ****** is less than 15%, the event judging means 422 will judge that the candidate concerned ****** is dry cough **** (step 809), and will advance processing to step 812.

[0050] The kurtosis of the candidate ****** is 40% or more and 55% or less, and by starting, if inclination is 15 or less mses, the event judging means 422 will judge that the candidate concerned ****** is dry cough **** (step 809), and will advance processing to step 812.

[0051] E. When the actual respiratory sound was processed using the candidate ****** of effectiveness this example, 85% or more of **** which the observer caught could be detected, and there were also very few incorrect judgings of sounds other than ****, such as voice.

[0052] In the <example 2> example 1, although ****** of an I-beam-III mold was counted separately, at this example, these were counted collectively. That is, it replaced with processing of steps 806-808, the event judging means 422 judged that the candidate ****** whose kurtosis the standup inclination of the candidate of a processing object ****** is 30 or less mses, and is 55% or less is ******, and the step which advances processing to step 813 was prepared. In connection with this, by this example, it held for the count storage means 46, without distinguishing dry cough **** and productive cough ****, and the display in the display means 45 was also performed, without distinguishing these.

[0053] According to this example, although precision was a little inferior to the example 1, about 80% of **** which the observer caught could be detected, and there were also very few incorrect judgings of sounds other than ****, such as voice.

[0054]

[Effect of the Invention] According to this invention, it is detectable with a sufficient precision about both dry cough gargling and productive cough gargling.

[Translation done.]

* NOTICES *

Japan Patent Office is not responsible for any damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] A sound pressure curvilinear creation means to create a sound pressure curve from the sound signal which continued by time series, The candidate [******] extract means which the sound pressure beyond a predetermined value extracts the field maintained beyond predetermined time, and makes the candidate ******, from the above-mentioned sound pressure curve, It has a ****** detection means to judge whether it is ******, for every above-mentioned candidate ******. The above-mentioned ****** detection means ****** detection equipment characterized by having an event measurement means to measure standup inclination and kurtosis of the above-mentioned candidate ******, and an event judging means by which the above-mentioned candidate ****** judges whether it is ****** based on the above-mentioned standup inclination and kurtosis.
[Claim 2] It is ****** detection equipment according to claim 1 with which the above-mentioned event judging means is equipped with a means to judge that the candidate ****** who has the above-mentioned standup inclination and the above-mentioned kurtosis within the limits of predetermined, respectively is ******, the upper limit of the above-mentioned range of the above-mentioned standup inclination is 10 - 160 ms, and the above-mentioned range of the above-mentioned kurtosis is characterized by an upper limit being 55 - 60%.
[Claim 3] The above-mentioned event measurement means measures further the location of the maximum sound pressure in the above-mentioned field of the above-mentioned candidate ******. The above-mentioned event judging means It has a means to judge tha the candidate ****** who has the above-mentioned standup inclination, the above-mentioned kurtosis, and the above-mentioned maximum-sound-pressure location within the limits of predetermined, respectively is dry cough ****. The above-mentioned range of the above-mentioned standup inclination It is ****** detection equipment according to claim 1 with which an upper limit is 10 - 160 ms, and the above-mentioned range of the above-mentioned kurtosis is characterized by for an upper limit being 30 - 40%, and the upper limit of the above-mentioned maximum-sound-pressure location being 40 - 60%.
[Claim 4] A minimum is ****** detection equipment according to claim 1 or 3 with which the above-mentioned event judging means is equipped with a means judge that the candidate ****** to whom the peak in the above-mentioned field of the candidate ****** is two or more, and the above-mentioned standup inclination and the above-mentioned kurtosis have it within the limits of predetermined, respectively is productive cough ****, the upper limit of the above-mentioned range of the above-mentioned standup inclination is 5 - 100 ms, and, as for the above-mentioned range of the above-mentioned kurtosis, 30 - 40% and an upper limit are characterized by to be 55 - 60%.
[Claim 5] It is ****** detection equipment given in either of claims 1, 3, and 4 to which the above-mentioned event judging means is equipped with a means judge that the candidate ****** to whom the peak in the above-mentioned field of the candidate ****** is two or more, and the above-mentioned standup inclination and the above-mentioned kurtosis have it within the limits of predetermined, respectively is productive cough ****, the upper limit of the above-mentioned range of the above-mentioned standup inclination is 10 - 160 ms, and the above-mentioned range of the above-mentioned kurtosis is characterized by for an upper limit to be 30 - 40%.
[Claim 6] It is ****** detection equipment according to claim 1 to 5 with which the above-mentioned event judging means is equipped with a means to judge that the candidate ****** who has the above-mentioned persistence time and the above-mentioned standup inclination within the limits of predetermined, respectively is dry cough ****, the upper limit of the above-mentioned range of the above-mentioned persistence time is 40 - 100 ms, and the above-mentioned range of the above-mentioned standup inclination is characterized by an upper limit being 5 - 200 ms.
[Claim 7] The above-mentioned range of the above-mentioned kurtosis is ****** detection equipment according to claim 1 to 6 with which it is characterized by equipping the above-mentioned event judging means with a means to judge that the candidate ****** who has the above-mentioned kurtosis within the limits of predetermined is dry cough ****, and an upper limit being 5 - 30%.
[Claim 8] A minimum is ****** detection equipment according to claim 1 to 7 with which the above-mentioned event judging means is equipped with a means to judge that the candidate ****** who has the above-mentioned standup inclination and the above-mentioned kurtosis within the limits of predetermined is dry cough ****, the upper limit of the above-mentioned range of the above-mentioned standup inclination is 10 - 160 ms, and, as for the above-mentioned range of the above-mentioned kurtosis, 30 - 40% and an upper limit are characterized by being 55 - 60%.
[Claim 9] ****** detection equipment according to claim 1 to 8 characterized by having further a ****** count means to count the coun of detected ******.
[Claim 10] ****** detection equipment according to claim 1 to 9 characterized by having further a microphone for extracting the above-mentioned sound signal.
[Claim 11] The above-mentioned sound pressure curvilinear creation means is ****** detection equipment according to claim 1 to 10 characterized by having a rectifier circuit and a filter circuit.
[Claim 12] ****** detection equipment according to claim 1 to 11 characterized by having further a means to receive an input although the signal of the voice recorded beforehand was enciphered, and the means which decrypts the signal by which encryption was carried out [above-mentioned], and is made into the above-mentioned sound signal.